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SUBTEST AND COMPOSITE VALIDITY OF ASVAB FORMS 11, 12, AND 13 FOR TECHNICAL TRAINING COURSES

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The validity of the Armed Services Vocational Aptitude Battery (ASVAB) subtests and composites for predicting final school grades in 150 technical schools was investigated. After correction for restriction of range and predictor unreliability, Paragraph Comprehension was found to be the most valid subtest (average r = .77) across all the schools. Within the traditional classification categories of Mechanical, Administrative, General, and Electronics (M, A, G, & E), Arithmetic Reasoning was found to be the most valid subtest after correction for range restriction. Except for the Electronics composite, the specific composite (M, A, G, & E) used for classification was not as valid as the Armed Forces Qualification Test (AFQT) nor the sum of the four Air Force composites, both of which are measures of psychometric g--general cognitive ability. The Administrative composite was less valid under all circumstances than the three other composites, the AFQT, or the sum of M, A, G, & E. Best-weighted-regression-based composites were slightly more predictive than the sum of M, A, G, & E, but at the expense of penalizing good test performance through the use of negative weights. A selection and classification system based on either best-regression-weighted subtests or on the E composite and the AFQT would increase validity.

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SUBTEST AND COMPOSITE VALIDITY OF ASVAB FORMS 11, 12, AND 13 FOR TECHNICAL TRAINING COURSES

SUMMARY

This study evaluated the accuracy of the Armed Services Vocational Aptitude Battery (ASVAB) as a measure of how well recruits will do in Air Force technical training in the 150 largest schools. After correction for statistical artifact, the reading skills measure (Paragraph Comprehension) was found to be the best subtest indicator of training performance and the Electronics composite was the best indicator composed of an aggregate of subtests. The Armed Forces Qualification Test selection composite was found to be the most valid composite for all jobs except those traditionally classified in the electronics field where the Electronics classification composite was the best indicator of training success. The Administrative composite was less useful than all the other composites even in the jobs traditionally classified in the administrative field. A selection and classification system based on the AFQT selection composite and the E classification composite could increase the accuracy of prediction of training outcomes. Efforts should be made to simultaneously identify optimal classification composites and technical training school groupings for those composites.

INTRODUCTION

The American military uses the Armed Services Vocational Aptitude Battery (ASVAB), a multiple aptitude test, to select applicants for enlistment and to make classifications for initial training and job assignment. ASVAB content is based on the concepts of differential measurement and differential validity (Brogden, 1951). This foundation implies that specific subtests should be useful for predicting success in certain specifiable jobs and not in others. For example, mechanical knowledge subtests should predict job and training performance in mechanical jobs, clerical-speed subtests should predict performance in administrative jobs, and technical knowledge should predict performance in technically oriented jobs. To this end, the content of the ASVAB is varied, containing measures of verbal, mathematical, clerical-speed, and technical aptitudes.

Composites of these tests of specialized knowledge have been formed in the hope of differentially predicting success on the jobs. For example, jobs that require mechanical skills were thought to be best predicted by the composite with a mechanical comprehension subtest, electrical jobs by a composite with electronics

information items and mathematics skills, and clerical jobs by a composite with tests traditionally identified as clerical speed such as rapid routine computation or rapidly encoding letters to numbers.

ASVAB is routinely validated against a number of criteria by each of the services (Booth-Kewley, 1983; Maier & Truss, 1985; Rossmeissl, Martin, & Wing, 1983; Teachout & Pellum, 1991; Welsh, Kucinkas, & Curran, 1990; Wilbourn, Valentine, & Ree, 1984). New forms of the ASVAB are produced at regular intervals, and validation is required to demonstrate that the new forms of the tests remain useful for predicting the criteria.

The Air Force aggregates the ASVAB subtests into four classification composites (Mechanical-M, Administrative-A, General-G, and Electronics-E). All Air Force jobs (Air Force Specialty Codes--AFSCs) are associated with minimum score requirements on one and sometimes two classification composites. These composites reify the belief in differential measurement and differential validity.

The Air Force computes a Department of Defense (DOD) selection composite, the Armed Forces Qualification Test (AFQT) and forms its own selection composite (MAGE) which is the sum of the four classification composites. To qualify for a job in the Air Force, the applicant must meet the minimum requirements for the: (a) DOD selection composite, (b) MAGE selection composite, (c) G classification composite used as a selection composite, and (d) the specific classification composite(s) associated with the Air Force job.

Individual AFSC-specific technical training course classification composites based on regression-weighted ASVAB subtests have been proposed to be used in the Air Force Person-Job Match (PJM). This is an automated system based on test scores which offers a list of Air Force specialties (AFSCs) to applicants. The subtest weights could be different for each job, which might be an indication of differential validity.

Finally, a comparison of the differences in validity among the composites can provide answers to questions about differential measurement and differential validity. Ree and Earles (1991) have shown that psychometric **g** (general cognitive ability) is the active ingredient in predicting training success. As each composite is a measure of **g** and specific ability, then the composites should differ in their ability to predict performance in concert with the categorization of the job. For example, if the AFSC is characterized as Administrative, then the Administrative composite should offer the best prediction; for Mechanical AFSCs, the Mechanical composite should be the best predictor; and so on. If the composite used to predict the performance is other than the best predictor, then the system is sub-optimal.

This study investigated the validity for final school grades of the existing subtests and composites, given the current grouping of jobs to M, A, G, and E.

METHOD

Subjects

The subjects were 88,724 first-term male and female non-prior-service Air Force recruits who were tested with ASVAB parallel Forms 11, 12, and 13 during the years 1984 to 1988. Only recruits who completed technical training and had course grade criterion measures were included in the study. Technical training courses with fewer than 100 graduates were not included. The demographic description of the subjects is shown in Table 1. The subjects were predominantly male, White, and high school graduates or beyond.

TABLE 1. DEMOGRAPHIC DESCRIPTION OF THE SAMPLE

Gender	Proportion	Age	Proportion
Male	82.8%	17-18	29.2%
Female	17.2%	19-20	37.7%
		21-22	18.8%
		23+	14.3%
Ethnicity		Education	
Black	14.8%	Less than High School	.9%
Hispanic	2.8%	High School Graduate	79.8%
White	80.3%	College Experience	16.1%
Other	2.1%	College Graduate	1.3%
		Other	1.9%

Measures

The predictors were the scores from the ASVAB taken for enlistment qualification (DOD, 1984). The ASVAB is a multiple-choice aptitude battery comprised of 10 subtests all of which are power tests with the exception of Numerical Operations and Coding Speed which are speeded. The subtest content and topology have been consistent since 1980. ASVAB Forms 8 through 22 are content and topologically equivalent. Table 2 shows the ASVAB subtests and composites and their reliabilities, as computed using measures of internal consistency (Cronbach, 1952; Wherry & Gaylord, 1943) for the power tests or test-retest method for the two speeded subtests and the composites (Palmer, Hartke, Ree, Welsh, & Valentine, 1988).

TABLE 2. ASVAB SUBTESTS AND COMPOSITES

Subtest	Number of Items	Time	Reliability
General Science (GS)	25	11	.80
Arithmetic Reasoning (AR)	30	36	.87
Word Knowledge (WK)	35	11	.87
Paragraph Comprehension (PC)	15	13	.67
Numerical Operations (NO)	50	3	.72
Coding Speed (CS)	84	7	.77
Auto and Shop Information (AS)	25	11	.82
Mathematics Knowledge (MK)	25	24	.84
Mechanical Comprehension (MC)	25	19	.77
Electronics Information (EI)	20	9	.71
Composites			
Armed Forces Qualification Test:	AFQT=2(WK+PC)+AR+MK		.90
Mechanical:	M=MC+GS+2AS		.90
Administrative:	A=WK+PC+NO+CS		.88
General:	G=WK+PC+AR		.91
Electronics:	E=GS+AR+MK+EI		.92
MAGE	MAGE=M+A+G+E		.96
Verbal	VE=WK+PC		.87

All test scores investigated were in the metric of the normative reference standard scores, which are based on a nationally representative sample of youth collected in 1980 (Maier & Sims, 1986; Ree & Wegner, 1990).

The criterion measures were the Final School Grades (FSGs) earned by students in 150 technical training courses. These usually range between 70 and 99 and are the average of a series (frequently four) of multiple-choice tests administered during the course. Additionally, in many courses students must pass work-sample performance checks to continue in training. Each technical training course scales the grades independently, and the grades are not on a common metric (Ree & Earles, 1991).

Data Analyses

FSGs were correlated with the ASVAB subtests and composites for all 150 AFSCs. Averages of correlations for sets of AFSCs were computed in both unweighted form with each AFSC given the same weight and in weighted form where each AFSC's correlation was weighted by the sample size. This weighting was done to keep correlations based on smaller samples from having the same impact on analyses as correlations based on large samples. Minimum and maximum values of

the correlations were determined. The procedures were repeated with the correlations corrected for range restriction by the multivariate procedure (Lawley, 1943; Mifflin & Verna, 1977). Additionally, some of the correlations were corrected for the unreliability of the ASVAB scores to illuminate certain theoretical concerns.

All statistical tests were conducted at the $p < .01$ Type I error rate.

RESULTS AND DISCUSSION

Table 3 presents the average correlations of the subtests and composites in both weighted and unweighted forms. The two sets of averages were very similar, with no differences greater than .02.

TABLE 3. AVERAGE CORRELATIONS OF ASVAB FORMS 11, 12, AND 13 SUBTESTS AND COMPOSITES FOR 88,724 SUBJECTS IN 150 AFSCS

Predictor	Unweighted Mean	Weighted Mean	Minimum	Maximum
GS	.26	.27	-.02	**.56**
AR	**.31**	**.31**	.00	.53
WK	.23	.25	.02	.43
PC	.22	.23	-.02	.41
NO	.09	.08	-.07	.32
CS	.12	.11	-.08	.30
AS	.24	.24	-.04	.42
MK	**.31**	**.31**	**.03**	.49
MC	.28	.27	-.05	.44
EI	.26	.27	-.07	.48
AFQT	.39	.40	.08	.55
M	.32	.33	-.01	.53
A	.21	.20	-.01	.41
G	.37	.37	.04	.55
E	.41	.41	.04	**.62**
MAGE	**.43**	**.43**	**.09**	.60
VE	.27	.28	.00	.48

Note. Column maxima are in boldface.

Table 4 presents the average corrected-for-range-restriction correlations of the subtests and composites in both weighted and unweighted forms. Again, the two sets of averages were very similar with few differences and none above .01. The highest

correlation of a subtest with the criterion was for **AR** (.68) both weighted and unweighted. The highest composite correlation (.73) with the criterion was obtained by the **E** and **G** classification composites, the **AFQT**, and the sum of **MAGE** selection composites--in both weighted and unweighted forms. The lowest correlation found was for the Coding Speed subtest, with .48 (unweighted) and .47 (weighted). The other speeded subtest, Numerical Operations, showed a relatively low correlation (.51 both weighted and unweighted) as did Auto and Shop Information, a test of specialized knowledge, at .52 unweighted and weighted.

TABLE 4. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS OF ASVAB FORMS 11, 12, AND 13 SUBTESTS AND COMPOSITES FOR 88,724 SUBJECTS IN 150 AFSCS.

Predictor	Unweighted Mean	Weighted Mean	Minimum	Maximum
GS	.65	.66	**.17**	.84
AR	**.68**	**.68**	.03	**.85**
WK	.65	.66	.06	.82
PC	.61	.62	-.01	.77
NO	.51	.51	.13	.68
CS	.48	.47	.08	.66
AS	.52	.52	.04	.70
MK	.65	.65	.11	.84
MC	.59	.59	.01	.73
EI	.61	.61	.06	.76
AFQT	**.73**	**.73**	[illegible]	**.91**
M	.64	.64	.06	.78
A	.63	.64	.18	.81
G	**.73**	**.73**	.04	.90
E	**.73**	**.73**	.09	.90
MAGE	**.73**	**.73**	**.20**	.89
VE	.67	.68	.04	.83

Note. Column maxima are in boldface.

Examination of results in Tables 3 and 4 clearly demonstrated no need to continue to discuss both weighted and unweighted correlations. Therefore, further comments address only the weighted correlations.

Comparisons of the entries in Tables 3 and 4 showed the pernicious effects of range restriction on correlation. The superior corrected-for-range-restriction correlation estimates in Table 4 were uniformly higher than the range-restricted correlations.

TABLE 5. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION AND UNRELIABILITY-OF-PREDICTOR CORRELATIONS OF ASVAB FORM 11, 12, AND 13 SUBTESTS AND COMPOSITES FOR 88,724 SUBJECTS IN 150 AFSCS.

Predictor	Unweighted Mean	Weighted Mean	Minimum	Maximum
GS	.73	.74	.13	.94
AR	.73	.73	.04	.92
WK	.70	.70	.07	.88
PC	**.75**	**.76**	-.01	**.95**
NO	.61	.61	**.15**	.80
CS	.54	.54	.08	.76
AS	.57	.58	.05	.77
MK	.71	.71	.12	.92
MC	.67	.67	.01	.83
EI	.73	.73	.08	.90
AFQT	.76	.76	.06	**.94**
M	.67	.67	.06	.83
A	.68	.68	.19	.87
G	.76	.76	.04	**.94**
E	**.77**	**.77**	.10	**.94**
MAGE	.74	.74	**.20**	.91
VE	.72	.73	.04	.90

Note. Column maxima are in boldface.

Table 5 shows the same correlations corrected for both range restriction and unreliability of the subtests or composites. Reliability estimates of the criteria were not made. These correlations represented the best estimates of the theoretical nature of the relationships of the ASVAB subtests and composites to the FSG criteria. The **PC** subtest showed the strongest predictive (.76) efficiency (Brogden, 1946). Ree and Earles (1990) have shown this subtest to be an excellent measure of general cognitive ability, psychometric **g**. Among the composites, **E** showed the highest correlation (.77) in the table, with **G** and **AFQT** at .76. The composites which had the lower validity subtests (NO, CS, AS, and MC) showed the lowest correlations with the FSG. Of the classification composites, only **E** exceeded the **AFQT** selection composite in predictive power and then merely by .01.

TABLE 6. RESULT OF REGRESSING CRITERIA ON ALL ASVAB SUBTESTS

AFSC	N	R	S_e	R_c	AFSC	N	R	S_e	R_c
11110	125	.28	4.08	.60	36130	223	.59	4.53	.83
11210	202	.41	3.91	.80	36131	223	.55	3.81	.83
11430	353	.60	4.30	.84	36231	195	.62	4.88	.86
12230	428	.47	4.33	.70	36234	212	.61	4.79	.87
20130	351	.50	4.27	.77	39130	210	.47	4.31	.72
20230	342	.52	2.67	.86	39230	463	.36	5.75	.56
20530	135	.54	4.59	.86	41130A	353	.50	4.24	.86
20630	214	.60	3.38	.85	41130B	337	.39	3.70	.78
20731	244	.46	4.50	.72	41131A	537	.54	4.25	.81
20833	240	.28	3.92	.38	41132A	255	.52	4.50	.77
20850	143	.34	5.85	.58	42330	876	.57	4.35	.80
23330	217	.58	4.37	.83	42331	376	.50	4.10	.76
25130	550	.50	4.04	.85	42634	219	.52	5.01	.79
27132	166	.41	4.82	.79	42731	427	.52	5.47	.83
27230	926	.50	4.84	.80	42734	129	.46	6.76	.72
27430	336	.44	4.93	.75	42735	756	.42	5.26	.72
27530	120	.55	4.21	.80	45231A	119	.54	3.63	.85
27630	117	.46	7.23	.70	45231C	122	.56	3.85	.80
27630B	120	.53	4.86	.81	45232A	144	.55	3.32	.89
27630C	669	.46	5.37	.77	45232B	135	.60	3.61	.92
29130	127	.62	4.75	.81	45232C	137	.63	3.52	.90
30230	173	.58	3.53	.86	45233A	114	.42	3.92	.75
30333	147	.52	3.43	.87	45233C	181	.52	3.81	.84
30430	238	.61	3.66	.90	45234	3,768	.54	5.80	.80
30431	203	.50	3.89	.84	45430A	1,821	.46	5.23	.71
30434	1,274	.46	3.92	.81	45430B	199	.53	4.50	.76
30534	106	.55	4.23	.80	45431	2117	.48	4.53	.76
30534E	189	.60	3.75	.90	45432	168	.47	5.33	.77
30630	358	.48	3.42	.81	45433	581	.47	4.58	.74
30633	291	.61	4.38	.90	45434	713	.52	5.54	.73
30650	125	.37	8.92	.69	45450A	541	.31	7.58	.46
32430	657	.54	4.11	.85	45530A	185	.41	3.78	.81
32530	402	.53	4.10	.83	45530B	190	.50	3.84	.83
32531	568	.52	3.97	.85	45533A	119	.38	4.15	.66
32830	554	.56	3.63	.87	45630	237	.44	3.58	.79
32831	524	.52	3.76	.86	45730	2,651	.52	5.80	.78
32833	474	.55	3.26	.88	45731	199	.58	4.61	.81
32834	276	.51	3.78	.84	45732	2,088	.53	5.75	.81

Table 6 (concluded):

AFSC	N	R	S_e	R_c	AFSC	N	R	S_e	R_c
45732C	180	.57	5.26	.83	60100	326	.23	6.31	.42
45831	200	.65	3.86	.83	60230	266	.47	5.30	.74
45833	296	.54	3.55	.77	60231	394	.50	5.46	.75
46130	2271	.51	4.25	.80	60530	325	.50	4.95	.78
46230C	384	.51	4.23	.76	60531	1052	.42	5.17	.69
46230D	244	.45	3.92	.75	62330	815	.34	5.63	.68
46230E	745	.49	4.07	.77	63130	1651	.34	5.38	.65
46230F	827	.46	3.83	.75	63150	123	.40	5.77	.62
46230H	262	.49	3.95	.77	64530	3483	.37	5.64	.67
46230J	108	.44	4.64	.72	64531	371	.49	5.58	.76
46230K	583	.42	4.87	.71	65130	188	.50	5.09	.77
46230Z	218	.52	4.05	.81	67231	482	.52	5.35	.77
46330	537	.60	3.45	.88	67232	706	.51	5.64	.78
46430	182	.54	5.05	.89	70130	135	.55	4.99	.83
46530	226	.35	4.75	.69	70230	3839	.43	4.94	.71
47230	241	.52	4.67	.73	73230	1603	.47	5.00	.78
47233	462	.49	5.16	.76	73231	116	.59	4.06	.84
49131	2152	.45	4.66	.83	75330	144	.49	5.69	.76
49132	250	.50	4.87	.92	81130	8384	.42	6.02	.74
49231	570	.51	5.76	.79	81132	3930	.52	4.78	.83
49330	498	.48	4.04	.85	81132A	549	.35	5.48	.68
49630	165	.44	3.66	.80	81150	687	.35	8.75	.62
54230	150	.57	4.80	.80	81152A	152	.31	5.53	.52
54231	211	.59	4.34	.82	90130	249	.49	4.04	.76
54323	422	.55	5.34	.82	90230	2210	.55	4.33	.85
54530	283	.61	5.31	.82	90232	203	.63	4.91	.88
54532	260	.47	5.08	.74	90330	286	.51	4.62	.79
55130	288	.49	4.76	.76	90530	254	.60	4.38	.86
55131	570	.53	3.31	.78	90630	916	.46	4.81	.78
55230	274	.43	4.76	.70	90730	160	.63	3.33	.88
55232	178	.53	4.44	.80	90830	173	.45	3.42	.81
55235	278	.46	5.83	.78	91130	126	.54	3.12	.84
55330	186	.32	4.89	.80	91530	372	.50	5.26	.81
55530	127	.46	5.62	.79	92430	425	.51	4.02	.79
56631	291	.58	5.81	.83	92630	236	.52	5.35	.81
57130	2047	.48	4.11	.77	98130	759	.43	4.33	.75
57150	166	.25	4.61	.36	98230	180	.54	3.75	.87

Note. N is sample size, R is observed multiple correlation, S_e is the standard error of estimate, and R_c is the multiple correlation corrected for range restriction.

The multiple regression of FSG on the 10 ASVAB subtests was computed for each AFSC. The course specific sample size, observed multiple correlation, standard error of estimate, and multiple correlation corrected for range restriction are presented in Table 6. These are frequently referred to as "best-weighted" or "regression-weighted" composites. The highest observed R was .65 (for AFSC 45831), and the lowest was .23 (for AFSC 60100). However, these multiple correlations were substantial under-estimates due to range restriction. Regressions using the correlation matrices corrected for range restriction on all subtests showed the highest multiple correlation to be .92 (for AFSC 49132 and 45232B) and the lowest to be .36 (for AFSC 57150).

The multiple correlations in Table 6 indicated which AFSCs would benefit from attempts to increase validity. For example, AFSC 49132, a computer programming job, was well predicted and would benefit very little from further efforts. AFSC 57150, a fire protection specialist job, was not predicted well and would benefit from additional studies.

Correlations of composites and subtests were also averaged within the **M**, **A**, **G**, and **E** groupings. This was done to investigate the aptness of the current classification composites for the existing job groupings. The aggregation of all jobs might tend to cancel these differences; so, it was necessary to investigate the jobs according to the selector composite to which the Air Force has allocated them. Understanding the appropriateness of the existing classification composites and current job groupings might demonstrate the necessity to develop new composites and or new job groupings. Included in these analyses were the subtests, **M**, **A**, **G**, and **E** classification composites, the **AFQT**, and the sum of **MAGE** selection composites.

The first AFSCs investigated were a group of 22 jobs that required some minimum score on the Mechanical classification composite. Table 7 shows that, on average, the most predictive subtests were **AR** and **GS** (.66) while the most predictive classification composite was **Electronics** (.73). For selection composites, the sum of **MAGE** was notably more predictive at .76 and the **AFQT** less predictive at .70.

The 11 AFSCs that were selected with the Administrative classification composite (Table 8) were best predicted by the **AR** (.67) subtest. The **A** (.65) classification composite was a worse predictor than either the **G** (.72) or the **E** (.70) classification composite. In fact, the **AR** subtest alone was more predictive than the **A** composite, which contains the **AR** subtest. Clearly, the Air Force could gain predictive efficiency for training criteria by replacing the **A** with the **G** classification composite for these 11 jobs.

For the 52 AFSCs selected with the **G** classification composite (Table 9), the most valid subtest was **WK** (.68). **G** was the most predictive classification composite at .73. The two selection composites, **AFQT** and sum of **MAGE**, were equally predictive (.74).

TABLE 7. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 22 AFSCS SELECTED USING THE M COMPOSITE WITH 7,433 SUBJECTS

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	.66	**.66**	**.58**	.77
AR	**.67**	**.66**	.57	.78
WK	.63	.63	.41	**.80**
PC	.59	.58	.37	.71
NO	.47	.47	.29	.62
CS	.43	.44	.36	.57
AS	.60	.61	.53	.70
MK	.61	.61	.54	.72
MC	.64	.64	.54	.70
EI	.65	.65	.50	.74
AFQT	.71	.70	.53	.85
M	.70	.70	.63	.78
A	.59	.60	.36	.76
G	.71	.71	.53	.85
E	.73	.73	**.65**	.81
MAGE	**.76**	**.76**	.63	**.87**
VE	.65	.65	.42	.80

Note. Column maxima are in boldface.

TABLE 8. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 11 AFSCS SELECTED USING THE A COMPOSITE WITH 8,711 SUBJECTS.

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	.63	.62	.59	.67
AR	**.68**	.67	**.63**	.73
WK	.66	.65	.61	.72
PC	.63	.62	.59	.70
NO	.55	.53	.47	.64
CS	.51	.51	.40	.66
AS	.43	.42	.39	.49
MK	.67	.66	.60	**.74**
MC	.53	.51	.49	.60
EI	.55	.54	.49	.60

Table 8. (Concluded):

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
AFQT	**.75**	**.73**	**.69**	**.78**
M	.56	.55	.48	.62
A	.67	.65	.58	.74
G	.74	.72	**.69**	.77
E	.72	.70	.67	.75
MAGE	.73	.71	.68	.76
VE	.69	.67	.63	.75

Note. Column maxima are in boldface.

TABLE 9. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 52 AFSCS SELECTED USING THE G COMPOSITE WITH 33,225 SUBJECTS

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	.63	.66	.11	.81
AR	.64	.66	.03	**.84**
WK	**.65**	**.68**	**.29**	.81
PC	.61	.64	.00	.77
NO	.51	.53	.13	.67
CS	.48	.48	.07	.62
AS	.45	.48	.04	.60
MK	.63	.64	.11	.73
MC	.53	.55	.01	.69
EI	.55	.59	.16	.71
AFQT	**.71**	**.74**	.06	.90
M	.57	.61	.05	.74
A	.63	.65	**.17**	.78
G	.70	.73	.04	.85
E	.69	.72	.09	.89
MAGE	**.71**	**.74**	.10	**.91**
VE	.66	.70	.03	.82

Note. Column maxima are in boldface.

There were 44 AFSCs requiring minimum scores on the E composite, and Table 10 shows that on average **AR** was the most valid subtest (.71). The E composite was the most valid classification composite (.77), and the **AFQT** and sum of **MAGE** selection composites were tied (.74).

TABLE 10. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 44 AFSCS SELECTED USING THE E COMPOSITE WITH 23,110 SUBJECTS

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	.68	.68	.31	.84
AR	**.72**	**.71**	**.41**	**.85**
WK	.66	.66	.29	.79
PC	.62	.61	.48	.77
NO	.52	.51	.26	.61
CS	.48	.46	.26	.60
AS	.56	.58	.31	.66
MK	.70	.67	.35	.84
MC	.64	.65	.37	.72
EI	.66	.67	.36	.75
AFQT	.76	.74	**.57**	.88
M	.68	.70	.45	.77
A	.64	.63	.32	.77
G	.75	.74	.56	.87
E	**.78**	**.77**	.56	**.90**
MAGE	.76	.74	.38	.88
VE	.68	.67	.31	.77

Note. Column maxima are in boldface.

There were 14 AFSCs that required a combination of minima on **M** and **E** or a minimum on either **M** or **E**, as shown in Table 11. The most valid subtests for these were **GS** and **AR**, both with correlations of .67. The most valid selection composite was the sum of **MAGE** with a correlation of .76. The **E** classification composite had the best predictive efficiency, .74.

TABLE 11. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 14 AFSCS SELECTED USING THE M AND OR THE E COMPOSITE WITH 9,030 SUBJECTS

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	**.67**	**.67**	.61	.72
AR	**.67**	**.67**	**.63**	.70
WK	.65	.63	.56	**.82**
PC	.60	.60	.53	.73
NO	.49	.48	.45	.57
CS	.45	.44	.41	.54
AS	.59	.60	.50	.68
MK	.62	.62	.58	.70
MC	.63	.64	.53	.71
EI	.65	.65	.54	.74
AFQT	.72	.71	.66	.83
M	.69	.70	.60	.77
A	.61	.60	.55	.74
G	.71	.71	.66	.84
E	.74	.74	.67	.82
MAGE	**.76**	**.76**	**.70**	**.87**
VE	.66	.65	.58	.83

Note. Column maxima are in boldface.

Finally, there were 7 AFSCs, presented in Table 12, that required some other combination of minima on two subtests which were not the **M** or **E** pair. The highest average validity for a subtest was **AR** (.61); the highest average validity for a selection composite was .66 for the **AFQT**. The most predictive classification composite was **G**, with a .65 correlation.

The findings for the composites were consistent with the findings of Stermer (1988), who investigated Forms 8, 9, and 10 using a smaller sample of jobs. Clearly, some changes to the composites or assignment of composites to jobs would benefit the Air Force.

TABLE 12. AVERAGE CORRECTED-FOR-RANGE-RESTRICTION CORRELATIONS FOR 7 AFSCS SELECTED USING COMBINATIONS OF COMPOSITES OTHER THAN M AND E WITH 7,220 SUBJECTS

Predictor	Unweighted Average	Weighted Average	Minimum	Maximum
GS	.57	.56	.39	.72
AR	**.64**	**.61**	**.56**	**.77**
WK	.61	.58	.51	.74
PC	.58	.56	.42	.72
NO	.49	.48	.41	.57
CS	.45	.44	.30	.56
AS	.42	.41	.30	.50
MK	.61	.60	.49	.76
MC	.50	.48	.37	.61
EI	.52	.50	.39	.62
AFQT	**.69**	**.66**	**.60**	**.84**
M	.53	.52	.38	.65
A	.60	.58	.49	.71
G	.68	.65	.57	.83
E	.66	.64	.52	.81
MAGE	.67	.65	.52	.82
E	.63	.60	.50	.77

Note. Column maxima are in boldface.

When the 150 AFSCs were investigated individually to determine the most valid subtest, **AR** was most frequently found to be best. (See Table 13.) In many cases, **AR** was declared superior to **MK** or **WK** by differences in the thousandths (i.e., a difference of perhaps .009). Among these 150 AFSCs, **E** was the most predictive classification composite 56% of the time; **G,** 36% of the time; **M,** 4% of the time; **VE** (considered as a composite for these analyses), 3% of the time; and **A,** only 1% of the time. Based on the .01 Type I error rate established for this study, **A** is not performing better than chance expectation. Additionally, the **AFQT** selection composite tied or exceeded the regulatory job-specific classification composite for 65 of 150 AFSCs, and 99 in 150 times the sum of **MAGE** selection composites equaled or exceeded the regulatory job-specific classification composite. This table too can be used to determine those AFSCs which would benefit from additional research on predictive efficiency enhancement.

TABLE 13. BEST SUBTEST, COMPOSITE, AFQT AND M, A, G, & E RANGE-RESTRICTED-CORRECTED PREDICTORS FOR AFSCS.

AFSC	Subtest	r	Composite	r	r-AFQT	r-M, A, G, & E
Aircrew Operations						
11110	WK	.54	G	.55	.58	.55
11210	WK	.75	VE	.77	.74	.74
11430	AR	.78	G	.81	.81	.83
Aircrew Protection						
12230	GS	.61	E	.66	.64	.68
Intelligence						
20130	EI	.60	E	.74	.74	.75
20230	MK	.78	G	.82	.84	.80
20530	AR	.77	G	.82	.80	.84
20630	GS	.73	E	.80	.80	.83
20731	WK	.63	G	.67	.69	.69
20833	CS	.25	A	.17	.06	.10
20850	CS	.44	A	.47	.42	.37
Visual Information						
23330	AR	.76	G	.81	.81	.82
Weather						
25130	AR	.77	G	.83	.84	.82
Command Control Systems Operations						
27132	WK	.72	G	.76	.76	.75
27230	WK	.73	G	.78	.79	.75
27430	WK	.67	G	.72	.71	.72
27530	WK	.67	E	.77	.73	.78
27630	WK	.64	G	.65	.66	.65
27630B	AR	.79	G	.80	.79	.76
27630C	AR	.71	G	.75	.76	.76
29130	MK	.70	E	.74	.74	.76

Table 13 (Continued):

AFSC	Subtest	r	Composite	r	r-AFQT	r-MAGE
Communication-Electronics Systems						
30230	EI	.75	E	.82	.80	.83
30333	AR	.79	G	.83	.84	.84
30430	AR	.85	E	.89	.86	.87
30431	AR	.78	E	.81	.79	.82
30434	AR	.74	E	.80	.76	.79
30534	MK	.75	E	.74	.67	.69
30534E	AR	.81	E	.87	.87	.88
30630	AR	.72	E	.78	.76	.79
30633	MK	.84	E	.88	.85	.85
30650	PC	.63	VE	.65	.64	.62
Precision Measurement						
32430	AR	.78	E	.84	.81	.84
32530	AR	.76	E	.80	.74	.79
32531	AR	.77	E	.84	.81	.85
32830	AR	.81	E	.86	.83	.86
32831	AR	.80	E	.84	.82	.83
32833	AR	.79	E	.86	.83	.87
32834	AR	.75	E	.82	.81	.83
Wire Communications Systems Maintenance						
36130	AR	.73	E	.78	.69	.80
36131	AR	.73	G	.79	.79	.80
36231	AR	.79	E	.84	.80	.83
36234	MK	.76	E	.85	.80	.84
Maintenance Management Systems						
39130	MK	.66	G	.64	.67	.62
39230	AR	.52	E	.53	.51	.53
Missile Systems Maintenance						
41130A	AR	.79	E	.83	.83	.85
41130B	MK	.70	E	.75	.75	.76
41131A	MC	.69	E	.76	.75	.79
41132A	EI	.64	E	.72	.71	.74

Table 13 (Continued):

AFSC	Subtest	r	Composite	r	r-AFQT	r-MAGE
42330	AR	.73	E	.79	.76	.79
42331	GS	.67	E	.73	.70	.75
42634	AR	.70	G	.75	.76	.77
42731	AR	.75	E	.81	.79	.82
42734	PC	.66	G	.70	.71	.67
42735	GS	.61	E	.68	.66	.71
Manned Aerospace Maintenance						
45231A	GS	.74	E	.82	.80	.82
45231C	MK	.67	E	.75	.73	.76
45232A	WK	.79	E	.86	.86	.87
45232B	GS	.84	E	.87	.88	.90
45232C	AR	.81	E	.85	.84	.86
45233A	MK	.70	E	.72	.66	.72
45233C	MK	.77	E	.82	.80	.82
45234	GS	.71	E	.78	.74	.80
45430A	AR	.63	E	.69	.67	.70
45430B	AR	.65	G	.71	.72	.73
45431	AR	.65	E	.72	.66	.74
45432	AR	.68	G	.72	.72	.75
45433	AR	.62	E	.68	.64	.70
45434	EI	.64	E	.70	.66	.71
45450A	AR	.41	E	.41	.38	.42
45530A	MK	.70	E	.77	.78	.79
45530B	AR	.73	E	.81	.78	.81
45533A	AR	.58	E	.58	.57	.57
45630	PC	.72	G	.73	.74	.72
45730	AR	.68	E	.76	.72	.77
45731	EI	.74	E	.75	.70	.77
45732	GS	.72	E	.78	.74	.80
45732C	EI	.74	E	.78	.74	.81
45831	AR	.77	E	.82	.78	.80
45833	AR	.65	E	.72	.69	.74
Munitions and Weapons						
46130	GS	.71	E	.77	.76	.80
46230C	EI	.66	E	.72	.66	.73
46230D	GS	.66	E	.70	.70	.74
46230E	AR	.66	E	.72	.71	.76
46230F	GS	.65	E	.71	.69	.73

Table 13 (Continued):

AFSC	Subtest	r	Composite	r	r-AFQT	r-MAGE
46230H	AR	.70	E	.75	.74	.75
46230J	WK	.63	E	.67	.68	.70
46230K	AR	.63	E	.69	.66	.70
46230Z	WK	.70	E	.77	.77	.80
46330	WK	.80	G	.84	.85	.87
46430	WK	.82	G	.84	.83	.87
46530	WK	.63	G	.68	.68	.64
Vehicle Maintenance						
47230	MC	.63	M	.67	.53	.63
47232	AS	.69	M	.75	.61	.71
Communications-Computer Systems						
49131	AR	.75	G	.80	.81	.81
49132	AR	.84	G	.89	.90	.91
49231	WK	.71	G	.76	.78	.76
49330	AR	.79	E	.85	.82	.84
49630	AR	.74	G	.77	.78	.72
Mechanical/Electrical						
54230	EI	.74	E	.74	.68	.75
54231	WK	.70	E	.78	.77	.81
54232	AR	.74	E	.81	.77	.81
54530	GS	.72	M	.77	.72	.78
54532	MC	.66	E	.71	.68	.73
Structural/Pavements						
55130	GS	.67	E	.72	.68	.74
55131	GS	.67	E	.74	.70	.77
55230	AR	.60	E	.66	.62	.68
55232	AR	.70	E	.77	.73	.77
55235	MC	.69	M	.74	.67	.75
55330	AR	.72	E	.78	.76	.78
55530	WK	.69	M	.76	.76	.71
Sanitation						
56631	GS	.73	E	.80	.78	.83

Table 13 (Continued):

AFSC	Subtest	r	Composite	r	r-AFQT	r-MAGE
Fire Protection						
57130	GS	.69	E	.74	.74	.77
57150	GS	.31	M	.32	.28	.30
Transportation						
60100	AR	.38	E	.40	.39	.41
60230	MK	.66	E	.71	.72	.71
60231	AR	.70	E	.74	.74	.74
60530	AR	.71	G	.75	.75	.74
60531	AR	.64	E	.68	.66	.68
Services						
62330	WK	.60	G	.65	.66	.66
Fuels						
63130	AR	.58	E	.62	.60	.64
63150	AR	.56	G	.57	.56	.52
Supply						
64530	MK	.60	G	.64	.66	.63
64531	MK	.68	E	.72	.74	.73
Contracting						
65130	MK	.68	G	.73	.75	.74
Financial						
67231	AR	.71	G	.75	.76	.73
67232	WK	.70	G	.75	.77	.75
Information Management						
70130	WK	.74	G	.81	.81	.78
70230	AR	.65	G	.69	.70	.68

Table 13 (Concluded):

AFSC	Subtest	r	Composite	r	r-AFQT	r-MAGE
Personnel						
73230	AR	.71	G	.75	.77	.75
73231	MK	.74	G	.75	.77	.73
Education and Training						
75330	WK	.68	G	.71	.71	.73
Security Police						
81130	WK	.68	G	.72	.72	.72
81132	WK	.77	G	.81	.81	.81
81132A	WK	.63	G	.65	.66	.64
81150	WK	.56	G	.59	.60	.61
81152A	PC	.42	VE	.40	.42	.37
Medical						
90130	AR	.69	E	.73	.69	.74
90230	WK	.78	G	.83	.83	.83
90232	GS	.81	G	.83	.84	.84
90330	WK	.71	E	.77	.78	.76
90530	PC	.76	G	.82	.84	.83
90630	WK	.71	G	.75	.77	.75
90730	WK	.81	G	.85	.87	.83
90830	WK	.74	G	.80	.80	.79
91130	WK	.78	VE	.79	.79	.79
91530	MK	.72	G	.77	.78	.72
92430	GS	.72	E	.77	.75	.77
92630	WK	.74	G	.78	.80	.78
Dental						
98130	WK	.69	G	.73	.74	.73
98230	WK	.79	E	.83	.84	.85

Although the **E** classification composite is promising it is not without concerns. The most prominent of these is the rate at which it unequally qualifies men and women. At normative percentiles (Maier & Sims, 1986) 20, 30, 40, 50, 60, 70, and 80, the percentage of males below these values were 16%, 24%, 32%, 41%, 51%, 61%, and 72% in the reference American youth population. Comparable percentages for women were 23%, 36%, 47%, 58%, 70%, 79%, and 88%. This means that at the 50th percentile fully 17 percent more males than females would qualify. The difference in qualifying rate never dips below 7 percentage points and reaches 19 percent in the mid-range of the distribution--the area of maximum density of the scores. This result does not occur with the **AFQT** selection composite, and it was only slightly less valid than the **E** classification composite. At **AFQT** normative percentiles 20, 30, 40, 50, 60, 70, and 80, the percentages of males below these values were 20%, 30%, 38%, 47%, 58%, 67%, and 77% in the reference American youth population. The same percentages for women were 20%, 30%, 42%, 52%, 64%, 73%, and 84%. In the lower third of the distribution, there were no differences between the score percentages for men and women. In the mid-range of scores, the average difference between men and women was 5 percentile points. The difference for men and women on **E** is three times greater in this important portion of the distribution, again with qualifying rates for males being higher than for females.

Clearly, the **A** composite was not terribly helpful in the selection and classification of Air Force enlistees, even in the jobs for which it is ostensibly appropriate. It could profitably be replaced. The **M** composite could also be replaced, with an increase in validity. Every job in the Air Force could be assigned to either **AFQT** or **E** as composites, for a net gain in predictive efficiency. However, the unequal sex qualifying rates of **E** might preclude its fair use. Finally, all jobs could be selected with **AFQT** with but a little less validity than using **E**.

A comparison of the validity correlations for the best-weighted-regression-based composites and the validity correlations for the sum of **MAGE** showed a difference of only +.03. This is a small gain for the computation of many potentially unstable weights. The increase will lose little in cross-validation. Also many of the regression weights will be negative and will serve to punish applicants with high test scores.

CONCLUSIONS

Results of this effort illuminate the need to investigate the validity of ASVAB for gender and ethnic groups. Additionally, the classification efficiency of the ASVAB subtests and composites should be investigated, as should the clustering of jobs and the composition of composites.

Finally, Tables 6 and 13 should be consulted to determine which AFSCs would benefit from further research efforts. Increasing the validity of one or two AFSCs may not be readily apparent in average validity figures, but the benefit for the technical training schools could be large. For example, AFSCs 20833, Apprentice Slavic Crypo

Linguist Specialist, and 39230, Apprentice Maintenance Scheduling Specialist, were the two most poorly predicted apprentice technical schools. Increases in predictive validity, coupled with proper qualification cutting scores for these schools, could decrease the attrition rate and increase the expected performance of graduates.

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